balances the value of the fuller explanation. To explain *solidity* we are told that "A solid is characterised by a greater or less degree of rigidity," which in the absence of a separate definition of rigidity leaves us much where we were before. Again, the definition of a *liquid* is this, "A liquid is characterised by its mobility; the molecules are free to move about each other, and the liquid takes the shape of any containing vessel," which is equally true of a *gas*. The proof of the formula $S = \frac{1}{2}ft^2$ is clenched by the proposition that "when two sets of variable quantities, which are always equal, simultaneously approach their limits, these limits are equal," which is suddenly introduced without any explanation of its meaning. This, in a book intended for beginners unacquainted with the idea of a "limit," would be likely to cause some bewilderment. There is a chapter devoted to Work and Energy, as should be the case with all text-books of mechanics nowadays.

In the dynamical section there is an entire omission of "Sliding in Chords of a Vertical Circle" and the pretty problems connected with it. In the statics there is no mention of the stability or instability of equilibrium of one curved surface rolling on another. The micrometer screw surprises us by appearing with the mechanical powers alongside of the wheel and axle and differential screw.

As the compiler has not acknowledged his indebtedness to other works, it is difficult to say how much of this book is original. But we seem to catch echoes of Ganot's "Physics" and of Goodeve's two text-books on Mechanics and Mechanism here and there. For instance, Articles 7, 8, 107, 111 remind one of Ganot, Articles 197, 207, 209, 239 of Goodeve. The woodcuts, some of which are good, and others (*e.g.* those in the chapter on Centre of Gravity) very indifferent, are 190 in number. Some of them are apparently reproductions of woodcuts in English books. We instance Figs. 44 and 175, which are strikingly like Figs. 365 [Joule's apparatus] and 19 [block and tackle] in the eighth edition of Ganot's Physics, translated by Atkinson, and Figs. 142*a*, 150, 152, 155 (in Dana), which bear a very close resemblance to Figs. 49, 58, 110, 113 respectively in Goodeve's "Principles of Mechanics," second edition, Fig. 117 in the latter having apparently supplied Dana's three figures, 162, 163, 164 [on Pulleys]. Fig. 145 in Goodeve's "Elements of Mechanism," fifth edition, may well have been the original of Dana's Fig. 156.

It would have been graceful in the compiler of this work to have expressed his acknowledgments to the two excellent little text-books of Goodeve. On the whole, with the reserve above made in favour of the "examples," we think that neither English teachers nor English students will be the losers if they continue to use already existing English text-books of Mechanics, and leave this American competitor to find an audience on the other side of the water.

CONSCIOUS MATTER

Conscious Matter; or, The Physical and the Psychical Universally in Causal Connection. By Stewart Duncan. (London: David Bogue, 1881.)

AS the title of this little work sufficiently indicates, the aim of its writer is to furnish a scientific basis for the theory of materialism in the region of mind. It is doubtful whether at this time of day anything very original can be said upon this topic, but Mr. Duncan has succeeded in placing some of the facts in a stronger light than previous writers. The facts to which we allude are those which he calls the "analogies" between forces and feelings. Up to a certain point it is by every one recognised that there is some quantitative relation between neurosis and psychosis; mental processes are universally known to entail wear and tear of cerebral substance. Mr. Stewart Duncan traces this quantitative relation as much into detail as he can, by setting forth in a series of twelve "analogies" the resemblances between forces and feelings. These "analogies" are far from being unopen to criticism severally; but here we shall merely mention what they are, as there is more important criticism to apply to them collectively. The analogies are that feeling and force are each without extension, both related to matter, have "plurality predicable of them as respects their locality," are diverse, have time-extension or duration, also the quality of degree and capability of being compounded or combined, are respectively transmutable *inter se*, &c. Doubtless, as Mr. Duncan observes, such analogies, or, as we should prefer to call them, parallelisms, might be largely multiplied; but what would any number of such parallelisms prove? Not, surely, what Mr. Duncan desires them to prove, viz. that forces stand to feelings in the relation of causes to effects. So far as the tracing of such mere parallelisms is concerned, we might almost as reasonably conclude the recent earthquake at Chio to have been the cause of this review, in that they each possess extension, have diverse parts, and so on. In order to establish a relation of causality we should require to show that the observed parallelism is due to that relation; we cannot argue from the observed parallelism as itself sufficient proof of such relation. Were this not so, there would be no need for Mr. Duncan or any one else to write a book on "The Physical and Psychical Universally in Causal Connection"; for as the fact of a constant parallelism between neural processes and mental processes is now no longer an open question, were mere parallelism sufficient to establish proof of causality, materialism would now be a demonstrated theory.

It is needless here to go into the whole question as to the relation of body and mind, or to point out all the shortcomings of materialism as a philosophical theory. But it is a defect in Mr. Duncan's work that he does not attempt to meet some of the most formidable of the difficulties with which this theory is beset. Thus he does not consider the fact that what we know as matter and force we know only as affections of mind, and therefore that in all speculations upon the nature and potentialities of the former, we already by implication have necessarily assumed priority of the latter. Nor does he seek to explain the apparent want of equivalency between supposed physical antecedents and supposed mental consequents—why it is that the brain of a Newton required less nourishment than that of an elephant. Lastly, the greatest of all the difficulties is not adequately treated—that, namely, which is connected with the doctrine of the conservation of energy. Are we or are we not to suppose that thought has a mechanical equivalent? If materialists say that we are, then thought itself becomes a mode of

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energy, or rather energy by becoming thought ceases to be energy—is destroyed as energy; and so this answer would militate against the doctrine in question. If, on the other hand, it is said that thought has no mechanical equivalent, and yet that energy causes thought, the statement is still in conflict with the doctrine of conservation, because it supposes that energy in the brain differs from energy everywhere else in producing more than its equivalent measure of result. How then under any view are we to conceive of thought as an *effect* of energy? By no stretch of imagination can we attain to the idea of a motor becoming a motive; and if we could attain to such an idea, it would seem to be at the cost of upsetting the most fundamental doctrine of modern physics. And let it be observed in this connection that Mr. Duncan is not very accurate in the statement of his first "analogy," where he says that "Feeling and Force are alike in being both destitute of space-extension." Force in activity is only known as motion in space, while Feeling in activity cannot be conceived as here or there; the conception of Force without any actual or potential relation to space is as impossible as the conception of Feeling in such a relation.

Mr. Duncan's book, however, is worthy of the attention of psychologists, because although we think his attempt to prove a causal relation between physics and psychics a necessary failure, his work is interesting and suggestive if viewed from the standpoint of Clifford's doctrine of "Mind-stuff." If we suppose that Force and Feeling are everywhere one, and so that "all the universe is made up of Mind-stuff," we have a logically possible theory which does not labour under any of the logical disadvantages attending the theory of causality proceeding from matter in motion to mind, or *vice versâ*. Some passages in Mr. Duncan's work seem to show that he has very nearly entered this conception himself; and we therefore feel that he would have written a more valuable treatise if, going a little further, he had discarded the obsolete attempt to explain parallelisms by an impossible theory of *causality*, and undertaken to argue that these parallelisms are really due to a fundamental *identity*, which, as Lewes puts it, is phenomenally diverse only in relation to our modes of apprehension.

GEORGE J. ROMANES

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.*]

Study of the Physical Nature of the Sun

HAVING been engaged for some time past in discussing with that able scientist, the Spanish Astronomer-Royal, Signor Antonio Aguilar, Director-General of both the Astronomical and Meteorological Observatories of Madrid, the best method of realising for the requirements of modern science the peculiar advantages presented by the Peak of Teneriffe for studying and eliminating the interfering effects of the earth's atmosphere on many classes of astronomical, meteorological, and physical observations—it has just resulted, not exactly in the general facilitation which I had hoped for towards the *savants* of all nations—but in a particular letter to myself of gracious recommendation by Spanish royal authority to the Captain-General of the Canarian Archipelago.

As however I am totally unable, for reasons well known to our own Government both now and for many years past, to undertake any such research, however useful or pressing—it may be of service to the cause, and to other workers who are more favourably situated financially, to make known how liberally the Spanish Government is inclined at the present moment towards any genuine efforts, even of individuals, to improve our knowledge of the great central luminary by making superior observations with improved instruments at some considerable level above the ordinary clouds and winds of the summer season; and which superiority of site can only be well obtained on this side of the world by means of that grand Mountain-island which Spain has ruled so long and so well,—viz. the Island of Teneriffe. I have therefore now the pleasure of appending a close translation of the official letter, or rather Royal Order, from Madrid,—a copy of which Don Antonio Aguilar kindly informs me has already been communicated by the Spanish Government to the Chief Governor of the Canarian Islands.

"*From the Ministry 'de Fomento,' Madrid, to the Director-General of Public Instruction.*

"ILLUSTRIOUS SIR,—In consequence of the Report of the Director-General of the Astronomical and Meteorological Observatories of this capital, the King has deigned to order that the Governor of the Province of the Canaries, and all authorities dependent upon him, should give special attention to provide whatever assistance he may require to Mr. Piazzi Smyth, Director of the Observatory, Edinburgh, in the expedition which is proposed to the Island of Teneriffe, with the object of trying, on the height of the Peak of Teyde, the instruments designed, or improved by him for the study of the physical constitution of the Sun.

"By Royal Order I transmit this to you for your information, and may God preserve you many years.

"(Signed) — — —
"On the 22nd March, 1881"

A friend well acquainted with both England and Spain informs me that we have not in this country any exact analogue to the Ministry "de Fomento." The literary or theoretical meaning of the word is "supporting, encouraging, cherishing"; and the practical result in this case has been, that a poor individual here, unrecommended by the Government, or the greater Learned Societies, or Universities of his own land, but having an *excelsior* natural object to labour at, has received this very honourable testimony and encouraging recommendation. All honour then to the Government of Spain therefor; and may they meet at last with a more worthy subject for their gracious "Fomento," than Your obedient servant,

Edinburgh, April 9 PIAZZI SMYTH

Winter Gnats (Trichocera)

THE winter gnat (*Trichocera hiemalis*, D. G.) is one of the subjects of phenological observations undertaken by the Meteorological Society. Its appearance directly after long-continued frost, often whilst the thaw is in progress, has frequently led entomologists to inquire whether the insects then seen have been hybernating during the cold weather, or have newly emerged from the pupa. No evidence has been adduced in support of either alternative. Some facts concerning the habits of the fly, noted as opportunity occurred during the last two winters, bear upon the matter in question, and may therefore be of interest to both the above classes of your readers. The name *Trichocera hiemalis* is used here in its meteorological sense, for nobody would pretend to distinguish this abundant species at a distance from the common *T. regelationis*.

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